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To compare the change in axial length and anterior chamber depth measured by Tomey's IOL Master in patients undergoing phacoemulsification surgery by using Sensor fold vsTecnis one lens.

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Abstract:
Background*:Phacoemulsification surgery for cataract is one of the most common surgeries performed all over the world. The objective of the surgery is to correct the vision by replacing the opacified lens by artificial lens. The power of this lens is not same for all and needs to be calculated individually before surgery. Axial length(AXL)& corneal curvature are most influencing parameters for calculating power of the lens.so this study was planned to measure the changes in axial length & anterior chamber depth(ACD) in pre & post operatives time.. Present study compares results of twosuch types of lenses TO & SF lenses which can be helpful for determining IOL power for the patient before surgery.*
Materials and Methods: *Surgical intervention was performed by expert surgeon for phacoemulsification using same technique. During the surgery two types of lens were used, namely Tecnis one (TO) & Sensor fold (SF).the choice of lens was random and not pertained to certain condition. The post-operative value noted a month after surgery and the collected data was subjected for analysis.*
Results:*The axial length in preoperative group was 23.47±2.12 ranging from 20.48 to 26.8. The postoperative group showed the average axial length as 23.24±1.95.Average Change in length for SF lens was 0.24 while that of TO was 0.21 on negative side. Average depth was found to be 3.71±1.35 in preoperative time.This average depth in post-operative time found to be 4.35±1.23.*
Conclusion:*This study concludes that there is a significant decrease in axial length post phacoemulsification surgery with increase in anterior chamber depth and hence these variations should be taken into account before calculating IOL power in the preoperative evaluation.*
Key Word*: axial length, anterior chamber depth, phacoemulsification.*

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I. Introduction

The most common correctable cause of blindness worldwide iscataract, and cataract surgery is one of the most commonly performed surgeries in the world.Today, cataract surgery, due to the phacoemulsification techniques, to the improvements in intraocular lens (IOL) calculations like Tomey's IOL Master, and to the IOL manufacturing, is considered one of the most successful procedures in ophthalmology. The calculation of IOL power is mainly based on the preoperative measurement of the mean corneal power (Km), the axial length (AL), and the estimation of the effective lens position. As these measurements are performed before surgery, normally they do not consider the subsequent changes that could be due to the interventionalprocedure, like change in physical dimensions of the eye post-surgery. It is well known that the surgical cut can induce modifications in corneal astigmatism,but we were not able to find studies that focused their attention on eventual changes in the Km. Regarding the AL changes after cataract surgery, many studies performed post operatively come to a conclusion that these changes does affect the surgical outcome ultimately. presently, after the introduction of the optical biometers,lot of evaluation has been done in the field.While calculating the power of the lens to be used during the surgery various formulae are used. They consist of changing variables and certain constants. The value of these constants changes as per the lens type & manufacturer recommendations. So it has been recommended to apply a correcting factor to measure the real AL after cataract surgery. The variables are measured in two settings where two type of lenses are used namely SF & TO lenses. Any change in pre && post-operative changes in the values depicts the change in expected outcome. This information can prove useful while calculating the variables for calculating IOL power by using standard methods for calculation for beforehand correction of the readings. This will ultimately serve a better outcome of the surgery

II. Material And Methods

This prospective comparative study was carried out on patients undergoing Phacoemulsification cataract surgery at Sankara eye hospital, Coimbatore, Tamilnadu. Total 100 adult subjects (both male and females) of aged ≥ 18, years were for in this study.

Study Design: Prospective open label observational study

Study Location: Sankara eye hospital, Coimbatore, Tamilnadu

Study Duration:.March 2019 to February 2020

Sample size: 100 patients.

Subjects & selection method: After explaining the details of the study, written informed consentwas obtained from all patients before enrolment.

Inclusion criteria:

1. *Adult patient with cataract of any grade.*
2. *Willing to participate &follow-up in the study*

Exclusion criteria:

1. History of previous eye surgery
2. Patients with significant pathology such as diabetic retinopathy, corneal dystrophy, past or present keratitis, glaucoma affecting the visual axis,
3. Patients withcorneal degenerations, corneal ectasias, or uveitis.

Procedure methodology

Patients who werewilling to participate in the study, identified pre-operatively & measurements noted in the well-designedproforma to obtain required information. The patients were explained about the procedure. Surgical intervention was performed by expert surgeon for phacoemulsification using same technique. During the surgery two types of lens were used, namely Tecnis one (TO) & Sensor fold (SF).the choice of lens was random and not pertained to certain condition. Patient was advised to follow-up for re-examination after 4th week to give sufficient time to settle the post-operative changes in the eye. On the follow up visit after one month again the same parameters are noted using IOL Master Machine and entered into the proforma. The collected data was subjected for analysis.

Statistical analysis

Statistical analysis was performed using SPSS software version 17 (SPSS, Inc., Chicago, IL, USA). The statistical test of significance was used to compare the differences between parametric data at one month after surgery in the same patients.*P* value of less than 0.05 was considered statistically significant.

III. Result

A total of 100 eyes were included in the study. The number of maleswas65 while 35 females were included in the study. Average age of the study was 61.86±20, with range from 44 years to 86 years.

Two types of lens were used in the study SF & TO. 57 subjects were operated with SF lens while TO lens was used in 43 patients.

Table no. 1. Demographics of population

Age group in years	Male	Female	Total
<55	18	10	28
56-65	27	12	39
66-75	10	9	19
76-85	9	3	12
>85	1	1	2
Total	65	35	100

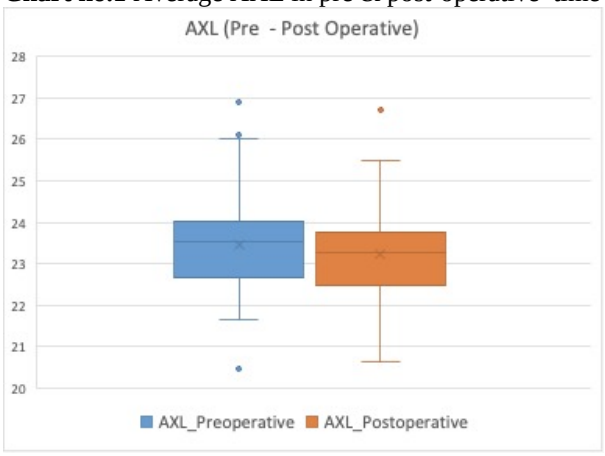
Axial length:

The axial length in preoperative group was 23.47±2.12 ranging from 20.48 to 26.8. The postoperative group showed the average axial length as 23.24±1.95. Ranging from 20.64 to 26.7

The change in axial length in pre &post-operative times was found to be statisticallynot significant (p>0.4) with pearson correlation of 0.965.

Average Change in length for SF lens was 0.24 while that of TO was 0.21 on negative side.

Chart no.1 Average AXL in pre & post-operative time



Anterior chamber depth:

In our study we found that the anterior chamber depth was ranging from 2.29 -5.56 with average depth was found to be 3.71±1.35 in preoperative time.

This average depth in post-operative time found to be 4.35±1.23ranging from 2.46- 5.63.

This change in anterior chamber depth was found to be statistically significant (p<0.0001)&pearson correlation of 0.7404.

The change in ACD after SF lens was 0.68. While that of TO it was found to be 0.57

Chart no. 2 ACD in pre & post-operative time

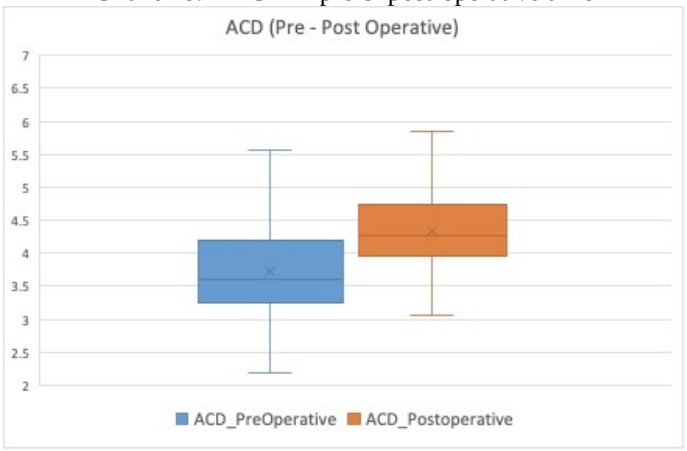


Table no. 2 comparison of AXL in SF & TO lenses

	SF lens	TO lens
Pre-operative AXL	23.39	23.57
Post-operative AXL	23.15	23.36

Chart no 3 comparison of AXL in SF & TO lenses

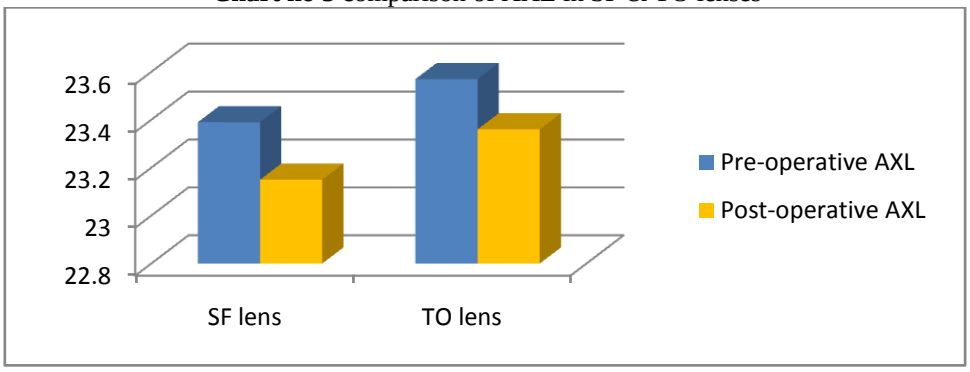
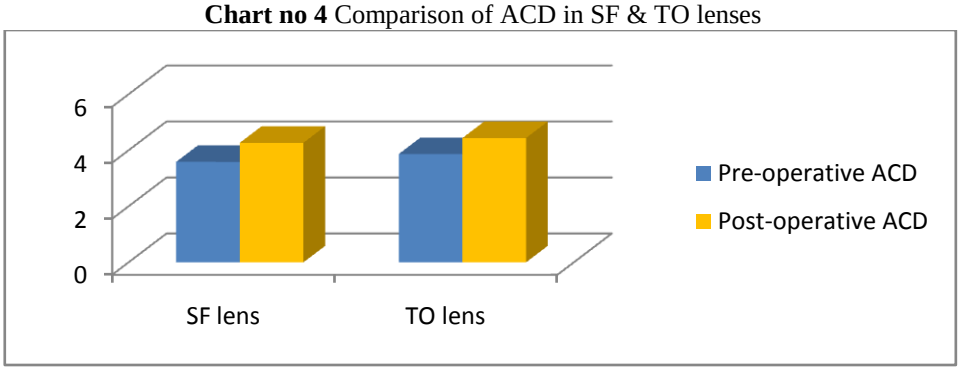


Table no. 3 Comparison of ACD in SF & TO lenses

	SF lens	TO lens
Pre-operative ACD	3.59	3.87
Post-operative ACD	4.27	4.44

Chart no 4 Comparison of ACD in SF & TO lenses



IV. Discussion

To measure the IOL power to be inserted in the eye in the case of cataract extraction, we preoperatively measure the AL of the eye. The power of the lens is calculate by IOL power formula. There are multiple confounding factors which change the reading for calculation of IOL power, refractive index of the lens, Km& accurate position of the pseudophakic lens are to name a few. Amongst the variables axial length happens to be the important factor as even a millimetre change in the axial length can change the power by 2 to 3D.[1,2] This ultimately affects the outcome of the surgery and hence it is important that in the pre op evaluation only this variable is noted with expected error correction.

However this axial length and corneal power does not remain constant in the preoperative & postoperative period in the same patient. Even the corneal power of the same eye changes in postoperative period than preoperative reading. The corneal curvature & anterior chamber depth affects the power of cornea. It has also been noted that this change in the ACD is not uniform in all the meridians. This is probably due to change in angle &backward shift of pupillary plane making iris in pseudophakic eye free from IOL contact. This causes changes in the anterior chamber depth of the eye in pre &post-operative time which also affects the post-operative visual acuity.For this reason several authors concentrated their attention on how to minimize astigmatism onset after surgery, focusing their attention to the astigmatism present before[1,2,3]and after surgery[4,5,6].

This change in AL &ACD can be due to the reduction in Km after the surgery could flatten the anterior chamber and consequently reduce the AL. The second hypothesis is that the extraction of the lens causes a decrease in the volume of the eye, with subsequent decrease in the AL. The third theory is that no changes are present, but rather the differences are due to an incorrect estimation in pseudophakic eyes, despite the change in AL measurement modality from phakic to pseudophakic, that could not be sufficient to correct the AL measurement. This change can just be the incorrect measurement is the preoperative one because we know the real refractive index of the implanted lens whereas the refractive index of the human lens could vary due to the cataract grade.

There are many types of lenses available in the market depending on the haptic and optic materials, design and place of instillation. Use of various types of lens depends on the requirement expected results personal experience and cost. It is very difficult to place any one type as superior above another as each has its unique specification. Different IOLs showed different trends when personalizing their A-constant even for the same range of axial lengths. Analysing the same comparative range of axial length among all groups, MA60AC showed no significant myopic/hyperopic shift within the range of 23.5-27 mm. A linear trend was found towards myopia with the increase of axial length in the Tecnis lens.[5,6]

Table no. 4 Results of various similar studies with respect to AXL

	AL pre (mean ± SD) mm	AL-range pre (mm to mm)	AL post (mean ± SD) mm	AL-range post (mm to mm)	AL difference (mean ± SD) mm
Lopez CG et al[7]	25.10 ± 3.19	20.54 to 36.06	24.88 ± 3.16	20.43 to 35.79	0.19 ± 0.05
Prinz et al[8]	23.47 ± 1.15	20.57 to 27.43	23.39 ± 1.15	20.39 to 27.39	0.07 ± 0.05
Drexler W et al[9]	23.49 ± 1.31	20.46 to 27.88	-	-	0.12 ± 0.06
Oslen T et al [10]	23.65 ± 1.25	18.96 to 29.02	23.57 ± 1.26	18.84 to 28.90	0.08 ± 0.12
Rajan MS et al[11]	23.47 ± 1.10	20.00 to 27.60	23.35 ± 1.10	-	0.13 ± 0.13
Our study	23.47±2.12	20.48 to 26.8	23.24±1.95	20.64 to 26.7	0.14±0.12

In our study, mean ACD in pre-operative patients was 3.71±1.35 while 4.35±1.23 in postoperative time.The change in ACD was found to be statistically significant p<0.0001.

Our study showed that the ACD significantly increasedfollowing cataract extraction. Central ACD has beenshownto increase following cataract surgery in many other similar studies.[12] Kurimoto et al. found a greater postoperative change in eyes with shallower anterior chambers.[12] Similarly, Shin et al.[13]also reported a significant increase in mean ACD postoperatively for their patients with occludable angles and found that anterior chamber deepening was inversely related to preoperative anterior chamber depth. These findings have also been reported in studies using AS-OCT.[14,15,16,17]Study done by Alio et al. However contradicts the findings in our study which can be due to interpersonal or technical variation or inaccuracy in suggested correcting factors.[18]

V. Conclusion

This study concludes that there is aninsignificant change in axial length post phacoemulsification surgery with any of SF & TO lenses. Also there is increase in anterior chamberdepthpost-surgery. These variations should be taken into account before calculating IOL power in the preoperative evaluation.

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